REMARKS

I. Introduction

Prior to a first Office Action in this application, the Applicants request that new claims 61-68 be added, and the application considered in light of the foregoing amendments and the following remarks. These amendments and new claims do not involve any new matter or objectionable changes.

II. The Cited References and the Subject Invention

A. The Karabinis Reference

U.S. Patent Publication No. 2002/0041575 A1, by Karabinis et al (hereinafter, Karabinis) discloses a system and method for coordinated satellite-terrestrial frequency reuse which efficiently reuses and/or shares at least a portion of the frequency spectrum between a first satellite spot beam and a second satellite spot beam, and/or an underlay terrestrial network associated with a second satellite spot beam. The spectrum is efficiently reused and/or shared between respective spot beams and/or associated underlay terrestrial systems in a manner minimizes interference between the respective satellite and terrestrial systems.

B. The Dent Reference

U.S. Patent No. 5,848,060, issued December 8, 1998 to Dent discloses a cellular/satellite communications system with improved frequency re-use. The system employs a multiple element antenna for receiving signals on a first frequency band and relaying the signals to a ground station on a second frequency band. The system includes a downconvertor for converting signals received at each of the multiple antenna elements on the first frequency band to corresponding baseband signals, and a multiplexor for time-division multiplexing the corresponding baseband signals to form a multiplexed sample stream. The system also includes a modulator for modulating a carrier in the second frequency band with the multiplexed sample stream and transmitting the modulated carrier to the ground station. In exemplary embodiments, the downconvertor comprises a quadrature downconvertor producing an I and a Q baseband signal. The satellite relays signals received from the ground station using a demultiplexor in a similar manner.

III. Written Opinion Remarks

As a threshold matter, the "Statement" of the Written Opinion indicates that claims 1-60 lack both novelty and an inventive step, while the "Citations and Explanations" refer only to the rationale behind the "inventive step." The Applicants presume that the Statement that claims 1-60 lack novelty is in error.

The written opinion indicates that claims 1, 10, 19, 25, 31, 40, 49, and 55 lack an inventive step under PCT Article 33(3) as being obvious over Karabinis in view of Dent. The Applicants respectfully disagree for the reasons described below.

The Applicants claims are directed to apparati and methods of conserving uplink bandwidth in a layered modulation system wherein the first layer and the second layer are independently transmitted to the same receiver in a layered modulation transmission scheme. Neither Karabinis nor Dent recognize or address this problem. It is therefore not surprising that even when combined, they do not disclose or suggest the features of the Applicants claims. Referring specifically to each independent claim:

With Respect to Claim 1: Claim 1 recites:

> *A system for uplinking signals, comprising:*
>
> *a first receiver for receiving a first feeder link signal using a first feeder link spot beam antenna for a first satellite transponder, the first satellite transponder transmitting an upper layer signal of a layered modulation signal to at least one receiver;*
>
> *a second receiver for receiving a second feeder link signal using a second feeder link spot beam antenna for a second satellite transponder, the second satellite transponder transmitting a lower layer signal of the layered modulation signal to the at least one receiver;*
>
> *wherein the first feeder link spot beam antenna transmits from a first coverage area and the second feeder link spot beam antenna transmits from a second coverage area distinct from the first coverage area and the second feeder link signal reuses a frequency spectrum of the first feeder link signal.*

The Written Opinion acknowledges that the Karabinis reference does not disclose "that the first satellite transponder and second satellite transponder fail to transmit an upper layer signal of a layer modulation signal to at least one receiver", but argues that the foregoing is taught by the Dent reference.

The Written Opinion first refers to FIG. 6, which is reproduced below:

FIG. 6

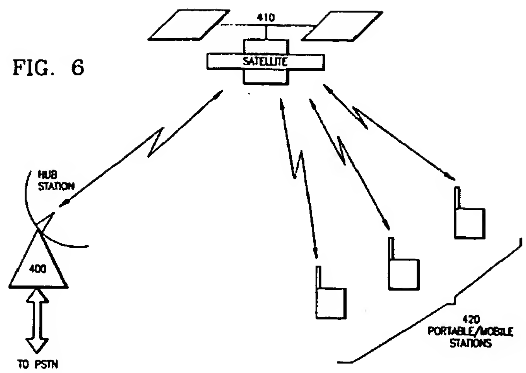

FIG. 6 illustrates a hub station transmitting to a plurality of portable mobile stations via a satellite. It plainly does not disclose the features of claim 1.

The Written Opinion also refers to the language of claim 1, namely:

A satellite communications system employing a multiple element antenna receiving signals on a first frequency band and relaying said signals to a ground station on a second frequency band including:

downconverting means for converting signals received at each of said multiple antenna elements on said first frequency band to corresponding baseband signals;

multiplexing means for directly receiving and time-division multiplexing said corresponding baseband signals to form a multiplexed sample stream; and

modulator means for modulating a carrier in said second frequency band with said multiplexed sample stream and transmitting said modulated carrier to said ground station;

wherein said downconverting means comprise quadrature downconverting means producing an I and a Q baseband signals.

The Applicants respectfully disagree that the foregoing teaches a first transponder transmitting the upper layer signal of a layered modulation signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver. It discloses is a multiplexer for forming a multiplexed stream from baseband signals downconverted from a first frequency, a modulator for modulating carrier with in a second frequency band and transmitting the modulated carrier to a ground station. The last phrase simply indicates that the downconverter produces an I and a Q baseband signal. Those are the well-known components of a signal constellation (see, for example, FIG. 14 of the Dent reference). That is not analogous to a first layer and a second layer of a layered modulation signal.

The Written Opinion also refers to the text associated with FIG. 7, namely:

FIG. 7 shows a block diagram of an exemplary satellite transponder for relaying mobile-originated signals to the hubstation. The L-band (e.g., 1600 MHz) multi-beam satellite antenna 470 receives

signals from a plurality of mobile phones distributed between the various beams and amplifies them in respective low-noise amplifiers 480. The composite signal from each beam contains, for example, signals from 400-500 mobile phones using different frequencies spaced at 12.5 KHz intervals over a total bandwidth of 6 MHz. The composite signals of each beam are downconverted in respective mixers 440 to obtain baseband signals, for example, spanning the range of 1-7 MHz. This type of signal will be referred to hereafter as a "video" signal as it is typical of the frequency range spanned by signals from a TV camera. To downconvert the composite received signal to the video signal, the downconverters can, for example, be image-rejection type downconverters. The downconversion process can optionally take place in one or more steps using appropriate intermediate frequencies.

The downconvertors in the system can use the same local oscillator signal so as to preserve the phase relationships at the downconverted frequencies that were received at the antennas. The inadvertent introduction of fixed phase mismatches and small amplitude differences between channels is not a problem as this can be calibrated out by analog or digital processing at the hubstation.

The baseband signals are used to modulate respective carriers at the satellite-hub frequency band, e.g., 20 GHz. If single-sideband modulation of a 1-7 MHz "video" signal were applied to a 20 GHz carrier frequency, the resulting signal would occupy the frequency range 20.001 to 20.007 GHz. However, using single-sideband modulation can make it difficult to preserve the phase coherency between the beam signals. Accordingly, double-sideband modulation techniques can be used instead. For example, the 1-7 MHz video signal can be used to frequency or phase modulate a 20 Ghz carrier frequency. The frequency range occupied by the modulated carrier would then be approximately 19.993-20.007 MHz, or more, depending on the frequency or phase deviation employed. To allow some margin over the bare 14 Mhz bandwidth, a 25 Mhz carrier spacing might be appropriate in the 20 Ghz band. Thus, 37.times.25 or 925 MHz can be used for the one-way satellite-hub link. This bandwidth can be halved by intelligent use of orthogonal polarizations as described later.

However, the foregoing merely discloses accepting a signal from a plurality of mobile units, downconverting, modulating and transmitting the combined signal to a ground station. This too, fails to disclose a first transponder transmitting the upper layer signal of a layered modulation signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver.

The Written Opinion also refers to FIG 8(a) and the text related thereto:

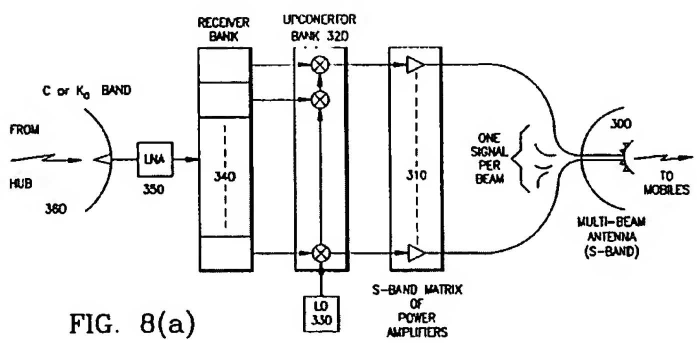

FIG. 8(a)

FIG. 8(a) shows an exemplary satellite transponder for the hub-mobile relay direction. The same method described above for the mobile-to-hub transmissions can be used in reverse for the coherent transport of multiple beam signals to the satellite. The hub station (not shown) transmits a number of Ka band frequency or phase modulated carriers to the satellite. These are

received using a suitable Ka band antenna 360, amplified in a common low-noise amplifier 350, and then fed to FM receiver bank 340 where each carrier is demodulated by a respective receiver to produce a video frequency version of the signals for transmission in respective beams. These video signals, for example occupying the band 1-7 MHz, are then upconverted in respective upconverters 320, using a common local oscillator 330 to preserve relative phase relationships, and then amplified using power amplifier matrix 310 for transmission via multi-beam antenna 300 to the mobile phones. A suitable frequency for the satellite-to-mobile link is, for example, 2.5 GHz (S-band). The amplifiers in the power amplifier matrix can be linear amplifiers to reduce intermodulation between signals destined for different phones. The power amplifier matrix can for example, either be a bank of n separate amplifiers each associated with respective beams, or a bank of N (greater or equal to n) amplifiers coupled by n*N Butler matrices at their inputs and N*n Butler matrices at their outputs. The effect of the Butler matrices is to use each amplifier to amplify part of every beam signal, thus evening the load, providing graceful degradation in the event of failure, and reducing intermodulation by absorbing a proportion of the intermodulation energy in N-n dummy loads. Examples of such power amplifier matrixes can be found in U.S. Pat. No. 5,574,967, entitled "Waste Energy Control and Management in Power Amplifiers" and filed on Jan. 11, 1994 which is incorporated here by reference.

According to another exemplary embodiment of the present invention, in communication systems using TDMA signals relayed through an earth-orbiting satellite having a communications transponder using such a matrix power amplifier, the power amplifier can have its input Butler combining network located at the ground station instead of the satellite. A Butler combining operation may be performed by digital signal processing at the ground station to form weighted sums of the desired beam signals to generate drive signals corresponding to each amplifier of the matrix power amplifier. These weighted sums are transmitted using coherent feeder links to the satellite's communications transponder which receives them and translates them to a second frequency band for driving the power amplifier in such a way that, after Butler combining the power amplifier outputs, the output signals correspond to signals desired to be transmitted in different antenna beam directions to respective ground-terminals, which may be, for example, a small handportable station.

FIG. 8(a) discloses the use of a receiver bank, upconverting the received signals to S-band, amplification by a bank of power amplifiers with one signal per beam, and transmitting the signal with a multi-beam S-band antenna. The text associated with FIG. 8(a) discloses that the power amplifier stage can be a bank of n separate amplifiers, each associated with a respective

beam, or a bank of N (greater than or equal to n) amplifiers coupled by n*N Butler matrices at their inputs and n*N Butler matrices at their outputs. The Butler matrices use each amplifier to amplify part of every beam signal, thus evening the load and providing a graceful degradation in the event of a failure. Transmitting an upper and a lower level modulation signal to the same receiver is certainly not disclosed here.

Finally, the Written Opinion also refers to FIG. 8(b) and the text related thereto:

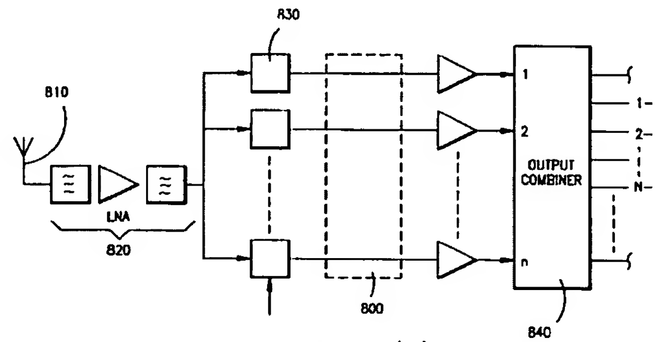

FIG. 8(b)

> The resulting satellite circuitry is shown in FIG. 8(b). Note that the input combiner which is normally present has been omitted since this function is now performed at the ground station, as illustrated by the dashed rectangular outline 800. The antenna 810, signal processing including linear amplifier 820, feeder link receivers and downconverters 830 and output combiner 840 can be implemented in the conventional manner and thus are not further described herein.
>
> This embodiment may be advantageous for certain situations, for example, dynamic reallocation of power between antenna beams and timeslots may be accomplished without large variations in the corresponding forward feeder link signals, because each feeder link carries part of every beamsignal instead of all of one beam signal. Additionally, pre-distortion of signals sent on the forward feeder links may be applied to further compensate for distortion in the associated transponder channel power amplifiers. Moreover, in the case of the over-dimensioned matrix power amplifier described in the above-incorporated "Waste Energy Control and Management in Power Amplifiers" application, the number of feeder links is greater than the number of independent beam signals to be created, thus affording a measure of redundancy against failure.

Clearly, the foregoing does not teach a first transponder transmitting a upper layer signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver.

<u>With Respect to Claim 10</u>: Claim 10 recites features largely analogous to those of claim 1, namely:

> *A method of uplinking signals, comprising:*
>
> *receiving a first feeder link signal using a first feeder link spot beam antenna for a first satellite transponder, the first satellite transponder transmitting an upper layer signal of a layered modulation signal to at least one receiver;*
>
> *receiving a second feeder link signal using a second feeder link spot beam antenna for a second satellite transponder, the second satellite transponder transmitting a lower layer signal of the layered modulation signal to the at least one receiver;*

wherein the first feeder link spot beam antenna transmits from a first coverage area and the second feeder link spot beam antenna transmits from a second coverage area distinct from the first coverage area and the second feeder link signal reuses a frequency spectrum of the first feeder link signal.

As was true with respect to claim 1, the Karabinis and Dent references fail to disclose a first transponder transmitting the upper layer signal of a layered modulation signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver. Hence, claim 10 demonstrates an inventive step over the references of record.

With Respect to Claim 19: Claim 19 recites:

A system for uplinking signals, comprising:
a first receiver for receiving a first feeder link signal for a first satellite transponder on a first satellite, the first satellite transponder transmitting an upper layer signal of a layered modulation signal to at least one receiver;
a second receiver for receiving a second feeder link signal for a second satellite transponder on a second satellite, the second satellite transponder transmitting a lower layer signal of the layered modulation signal to the at least one receiver;
wherein the second feeder link signal reuses a frequency band of the first feeder link signal and the first satellite and the second satellite have an orbital separation sufficient to allow reuse of the frequency band.

Like claim 1 and 10, claim 19 recites a first transponder transmitting a upper layer signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver. Unlike claim 1, claim 19 recites that the first satellite and the second satellite use orbital separation rather than spot beams.

With Respect to Claim 25: Claim 25 recites:

A method of uplinking signals, comprising:
receiving a first feeder link signal for a first satellite transponder on a first satellite, the first satellite transponder transmitting an upper layer signal of a layered modulation signal to at least one receiver;
receiving a second feeder link signal for a second satellite transponder on a second satellite, the second satellite transponder transmitting a lower layer signal of the layered modulation signal to the at least one receiver;
wherein the second feeder link signal reuses a frequency band of the first feeder link signal and the first satellite and the second satellite have an orbital separation sufficient to allow reuse of the frequency band.

As was true with respect to claim 19, the Karabinis and Dent references fail to disclose a first transponder transmitting the upper layer signal of a layered modulation signal to a receiver and a second transponder transmitting a lower layer signal to *the* (same) receiver. Hence, claim 25 demonstrates an inventive step over the references of record.

With Respect to Claims 31, 40, 49, and 55: Claim 31 recites:

A system for uplinking signals, comprising:

a layered modulation receiver/ demodulator for receiving and demodulating an upper layer feeder link signal and a lower layer feeder link signal both from a layered modulation feeder link signal;

a first modulator for modulating the upper layer feeder link signal to produce an upper layer signal of a layered modulation downlink signal to at least one receiver; and

a second modulator for modulating the lower layer feeder link signal to produce a lower layer signal of the layered modulation downlink signal to the at least one receiver.

Claim 31 recites a system which includes a layered modulation receiver and demodulator for demodulating an upper layer feeder link and a lower layer feeder link, and a first and second modulator for modulating the signals for transmission to the same receiver. Neither Karabinis nor Dent disclose layered modulation at all, let alone the transmission of a layered modulation signal as an uplink to a satellite.

Claim 40 recites similar features in the form of a method, and the same remarks apply. Claim 49 recites a system which includes a higher order receiver/demodulator and a demultiplexer for receiving and demodulating the feeder link signal into two bit streams, which are modulated into a layered modulation signal having a lower layer and an upper layer, which are both transmitted to the same receiver. Claim 55 recites similar features in the form of a method claim. The Karabinis and Dent references do not disclose a system demodulating and demultiplexing a higher order uplink signal and separately modulating the result into a lower and upper layer modulation signal transmitted to the same receiver. Accordingly, these claims include an inventive step as well.

With Respect to Claims 2-4, 11-13, 20-22, 32-34, 41-43, 50-52, and 56-58: Claim 2 recites that a first frequency bandwidth of the upper layer signal partially overlaps a second frequency bandwidth of the lower layer signal. Claim 3 recites that a first frequency bandwidth of the upper layer signal completely overlaps a second frequency bandwidth of the lower layer signal. Claim 4 recites that the upper layer signal comprises a legacy signal. According to the Written Opinion, these features are disclosed in FIG. 1 of the Karabinis reference in FIG. 1 and claims 1-10. However, FIG. 1 and the accompanying text do not disclose transmission of a layered modulation signal with upper and lower signal layers, that are partially or completely overlapping, and there is no notion whatever of a legacy signal.

With Respect to Claims 5-7, 14-16, 35-37, and 44-46: Claim 5 recites that the first transponder and the second transponder are on a common satellite, while claim 6 recites that the first transponder and the second transponder are each on a different satellite. According to the Written Opinion, these features are disclosed in claim 1 and figures 1, 2(a) and 8(a). While FIG. 1 indeed shows two satellites transmitting signals, Karabinis does not disclose the use of one satellite to transmit an upper layer of a layered modulation signal, and the other to transmit a

lower layer of a layered modulation signal. FIG. 2 discloses a cell pattern. Without further explanation, the Applicants do not understand how this discloses the features recited in the claims described above. FIG. 8(a) discloses a cell pattern with frequency re-use. The Applicants also do not understand the relevance of this figure to claims 5-7.

With Respect to Claims 8-9, 17-18, 23-24, 29-30, 38-39, 47-48, 53-54, and 59-60: The Written Opinion indicates that Karabinis discloses the features of claim 9 in claim 1 and in paragraphs [0038]-[0043] and [0140]-[0142] as follows:

> [0038] The present invention optionally provides both a terrestrial frequency assignment and/or reuse plan, and a satellite frequency assignment and/or reuse plan.
>
> [0039] In one embodiment of the present invention, a first spot beam or set of spot beams can reuse in a substantially central portion or pre-designated portion thereof, at least a portion of the frequency spectrum of one or more adjacent or nearby spot beams. The remaining portion of the spot beam is partitioned into, for example, a number of substantially equal sized subareas/subcells (hereinafter "subareas") extending radially from approximately the periphery of the central portion to or substantially to the spot beam boundary. Each of the central portions and the subareas will generally, although not necessarily, comprise one or more terrestrial cells. In addition, the terrestrial cells may cover at least a portion of one or more subareas and/or spot beams. Other configurations of subareas may also be used. The number of subareas is optionally equal to the number of adjacent cells or spot beams. For example, in a cluster size of seven, the center cell or spot beam will comprise a substantially central portion and six substantially equal size subareas, whereas in a cluster size of four, the cells or spot beams will comprise a substantially central portion and three substantially equal sized subareas. Any number of subareas, however, may alternatively be used.
>
> [0040] In another embodiment, the spot beam channels selected for terrestrial assignment and/or reuse are optionally selected beginning with the spot beam(s) farthest or substantially farthest away from the subarea of the spot beam under consideration, and proceeding to the spot beams closest (e.g., adjacent to) the spot beam subarea under consideration. The system and method of the present invention in this embodiment therefore generally maximizes the separation between the satellite frequencies that are reused terrestrially within the terrestrial cells.
>
> [0041] In accordance with another embodiment of the invention, satellite-terrestrial frequency assignment and/or reuse utilizes the inter-spot beam isolation (e.g., the isolation between the various spot beams). Thus, the terrestrial system associated with a particular spot beam and/or one or more subareas within a spot beam and/or one or more terrestrial cells preferably use satellite channels that are not utilized by the spot beam since the spot beam provides an isolation that can be utilized in reducing interference. In other words, one aspect of the present invention takes the co-channel, co-beam interference and "transfers" it to co-channel, adjacent beam interference.
>
> [0042] This feature of the present invention advantageously minimizes interference between adjacent satellites/spot beams and adjacent cells. The transmissions by the terrestrial network(s) will generally, to a certain extent and depending on the local attenuation, be "heard" by the associated satellite.
>
> [0043] It should be understood that the present invention can utilize and/or be deployed with all satellite (e.g., low-Earth orbit (LEO), mid-Earth orbit (MEO), geosynchronous orbit (GEO), etc.) and cellular terrestrial technologies (e.g., time division multiple access (TDMA), code division multiple access (CDMA), Global System for Mobile Communications (GSM), etc.). The present system may also assign, share and/or reuse frequencies of other domestic, foreign, and/or international satellite and/or terrestrial systems, subject to, for example, national, foreign, and/or international government regulatory approval.
>
> [0140] Within each spot beam (e.g., 802-814), the use of satellite frequencies by the terrestrial network results in co-channel/adjacent-bea- m interference. To utilize the isolation rendered by the availability of the spot beams, satellite terrestrial frequency reuse should preferably be implemented on adjacent

spot beams. The resulting co-channel/adjacent beam interference will generally be approximately reduced by the spot beam to adjacent spot beam isolation factor. It should be noted, however, that in a cluster of, for example, seven spot beams, as shown in FIG. 8a, each spot beam 802-812 has six adjacent spot beams that can contribute to the interference received. The advantage of co-channel/adjacent beam technique over co-channel/co-beam technique lay with the fact that not all spot beams have equal service demand. Consequently, the distribution of interference between adjacent spot beams can reduce the average interference in a high service demand beam. Any energy that is being generated by the spot beam channels within a 814 spot beam (e.g., 814) can be attenuated by the antenna pattern of the spot beam 814 satellite.

[0141] The frequency reuse scheme in accordance with the present invention therefore enables the total frequency band to be efficiently allocated (e.g., based on demand) between the terrestrial and satellite systems within each of the seven spot beams (802-814) and each of the respective terrestrial underlay systems associated therewith, while minimizing interference therebetween.

[0142] Consider FIG. 8a from a geographic perspective. As shown, New York city falls within spot beam 802, as well as terrestrial cell 816, Philadelphia falls within spot beam 814 and subarea 826, and Washington, D.C. falls within spot beam 808. Although terrestrial cells 816 can be located anywhere within the satellite spot beams (802-814), they will generally be located in, for example, metropolitan areas (e.g., New York, N.Y.) where satellite coverage may be limited due to, for example, capacity constraints or no line of sight or reduced line of sight between a subscriber terminal 512 and a satellite 516. This is one illustrative configuration, and is not intended to limit the invention in any way. If desired, spot beams 802-814, subareas 820-830, and/or terrestrial cells 816 can optionally be increased, decreased, and/or varied in number, size, and/or arrangement to yield a virtually infinite number of configurations that may be tailored to suit one or more geographic areas.

The Applicants do not believe that any of the foregoing text discloses adjusting the power level of the feeder link.

IV. New Claims

Claims 61-68 recite that the upper layer and lower layer signals are non-coherent. None of the cited references remotely disclose this feature. Hence, these claims include an inventive step over the references of record.

V. Conclusion

On the basis of the above remarks, reconsideration of this application and a favorable examination report are requested.

Please direct any inquiry to the below-signed attorney.

Respectfully submitted,

By: ______________________
Name: Georgann S. Grunebach
Reg. No.: 33,179

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The DIRECTV Group, Inc.
RE/R11/A109
P. O. Box 956
El Segundo CA 90245

Telephone No. (310) 964-4615